



Missouri Department of Natural Resources
Air Pollution Control Program
2010 Monitoring Network Plan

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APPENDIX 1: MISSOURI MONITORING NETWORK DESCRIPTION

Introduction

The Ambient Air Quality Monitoring Network for the State of Missouri consists of State and Local Air Monitoring Stations (SLAMS) and Special Purpose Monitoring Stations (SPMS) monitoring, with the intent to incorporate National Core (NCore) sampling no later than January 1, 2011, consistent with requirements in 40 CFR 58.10. The Missouri Department of Natural Resources operates an extensive network of ambient air monitors to comply with the Clean Air Act and its amendments. 40 CFR 58.10 requires that states submit an annual monitoring network plan including any proposed network changes. With regard to SLAMS changes, approval by the Environmental Protection Agency (EPA) Regional Administrator is required.

The plan must contain the following information for each monitoring station in the network:

1. The Air Quality System (AQS) site identification number for existing stations.
2. The location, including the street address and geographical coordinates, for each monitoring station.
3. The sampling and analysis method used for each measured parameter.
4. The operating schedule for each monitor.
5. Any proposal to remove or move a monitoring station within a period of eighteen months following the plan submittal.
6. The monitoring objective and spatial scale of representativeness for each monitor.
7. The identification of any sites that are or are not suitable for comparison against the annual PM_{2.5} National Ambient Air Quality Standard (NAAQS).
8. The Metropolitan Statistical Area (MSA), Core-Based Statistical Area (CBSA), Combined Statistical Area (CSA) or other area represented by the monitor.

Network Design

Appendix D to Part 58 establishes the design criteria for the ambient air monitoring network. The network is designed to meet three general objectives: provide air pollution data to the public in a timely manner, support compliance with ambient air quality standards and emissions strategy development, and support air pollution research studies.

Specific objectives for the monitoring sites are to determine the highest pollution concentrations in an area (peak), to measure typical concentrations in areas of high population density (population), to determine the impact of significant sources or source categories (source), to determine general background levels (background), and to determine the extent of regional pollutant transport among populated areas (transport). Minimum site requirements are provided for ozone and particulate matter based on metropolitan statistical area (MSA) population. NO₂ monitoring requirements are to be fulfilled in the plan to be submitted by July 1, 2012, including required roadside and area sites for large metropolitan areas. There are currently no minimum site requirements for carbon monoxide and sulfur dioxide, although the proposed sulfur dioxide NAAQS does include a scheme for determining required SO₂ monitoring. Current requirements for lead monitoring are being met, although this will need to be re-evaluated in the July 2011 plan based on the regulation.

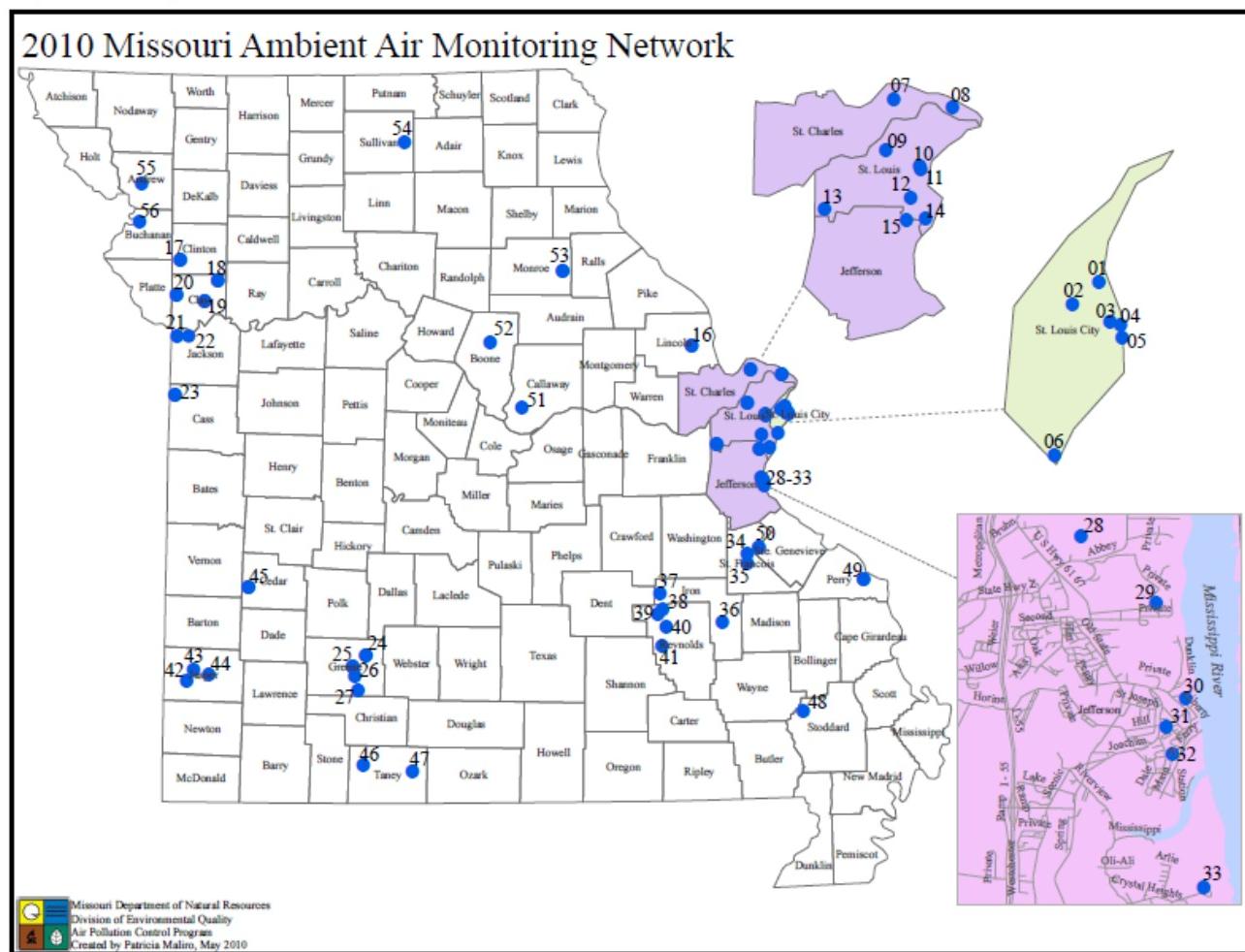
Appendix E to Part 58 establishes the specific requirements for monitor/probe siting to insure that the ambient data represents the stated objectives and spatial scale. The requirements are pollutant/scale specific and involve horizontal/vertical placement.

PM_{2.5} Standards

There is only one PM_{2.5} sampler in Missouri that is not applicable for comparison to the annual NAAQS - Branch Street. It is a middle-scale site focused on a group of sources in the industrial riverfront area and is not neighborhood scale.

Current Network

The current network is shown below in the map and table. It is our intent to change this network only minimally for the 2010 submittal, which follows.



Legend

<u><i>St. Louis Area</i></u>		<u><i>Herculaneum Area</i></u>		<u><i>Acronyms</i></u>	
Site#	Site Name	Parameter Monitored	Site#	Site Name	Parameter Monitored
01	Hall Street	PM ₁₀	28	Pevely North	Pb
02	Margaretta	PM ₁₀ , SO ₂ , NO ₂ , CO	29	Pevely	Pb
03	Blair Street	PM ₁₀ , PM _{2.5} (Spec), PM _{2.5} , PM-Coarse, O ₃ , CO, SO ₂ , NOx/NOy, Carbonyls, BC, WS, WD, OT, SR, BP	30	Sherman Drive	Pb
04	Branch Street	PM ₁₀ , PM _{2.5} , WS, WD	31	Herculaneum, Dunkin H. Sch.	Pb
05	Mound Street	PM ₁₀	32	Herculaneum, Main Street	SO ₂ , Pb, WS, WD
06	South Broadway	PM _{2.5} , SO ₂	33	Ursuline North	Pb
07	West Alton	O ₃ , NO ₂ , WS, WD, OT, SR			
08	Orchard Farm	O ₃			
09	Maryland Heights	O ₃ , SO ₂ , NO ₂ , WS, WD, OT			
10	Ladue	PM _{2.5} (Spec), PM _{2.5} , SO ₂ , NO ₂ , WS, WD, OT	34	Park Hills	Pb
11	Clayton	Pb	35	St. Joe State Park	Pb
12	Sunset Hills	NO ₂ , CO, WS, WD, OT			
13	Pacific	O ₃ , WS, WD, OT			
14	Oakville	PM ₁₀ , WS, WD	36	Glover	Pb
15	Arnold West	PM _{2.5} (Spec), PM _{2.5} , O ₃ , WS, WD, OT	37	Bixby West	Pb
16	Foley	O ₃ , WS, WD, OT	38	Oates	Pb
			39	Bills Creek	Pb
			40	Fletcher	Pb
			41	Corridon	Pb
<u><i>Kansas City Area</i></u>		<u><i>New Lead Belt Area</i></u>		<u><i>Acronyms</i></u>	
Site#	Site Name	Parameter Monitored	Site#	Site Name	Parameter Monitored
17	Trimble	O ₃ , WS, WD			NH ₃
18	Watkins Mill	O ₃			H ₂ S
19	Liberty	PM _{2.5} (Spec), PM _{2.5} , O ₃ , NO ₂ , WS, WD, OT, SR	42	Webb City	Pb
20	Rocky Creek	O ₃ , WS, WD			BC
21	Troost	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , OT			WS
22	Front Street	PM ₁₀	43	Alba	O ₃
23	Richards	PM _{2.5} , O ₃ , WS, WD	44	Carthage	PM ₁₀ , WS, WD
	Gebauer-South		45	Eldorado Springs	PM _{2.5} , O ₃ , WS, WD, IMPROVE
24	Fellows Lake	O ₃ , WS, WD	46	Branson (SPM)	O ₃ , WS, WD
25	Hillcrest H. Sch.	O ₃ , NO ₂	47	Hercules Glades	IMPROVE
26	Missouri State University	PM ₁₀ , PM _{2.5} , SO ₂ , CO	48	Mingo	IMPROVE
27	South Charleston	SO ₂	49	Farrar	O ₃ , WS, WD
			50	Bonne Terre	PM _{2.5} (Spec), O ₃
			51	New Bloomfield	O ₃ , WS, WD
			52	Finger Lakes	O ₃
			53	Mark Twain State Park	PM ₁₀ , O ₃ , WS, WD
			54	Green City	H ₂ S, NH ₃ , WS, WD
			55	Savannah	O ₃ , WS, WD
			56	St. Joseph Pump Station	PM ₁₀ , PM _{2.5} , PM-Coarse, OT

Proposed Changes to the Network

1. Lead

We have been informed in discussions with OAQPS (Kevin Cavender, May 4, 2010) that although the proposed reconsidered lead monitoring requirements for the recently revised standard indicated a due date of June 30 for the plan for monitoring sources 0.5 tons per year to 1.0 tons per year, this will be revised in the final document to submission no earlier than six months following the final rule, or possibly upon submission of the July 1, 2011, annual network plan.

The proposal also indicates that monitoring is now to be required at NCore sites along with the other required parameters. 40 CFR 58 Appendix D will then call for NCore sites to measure PM_{2.5} mass, speciated PM_{2.5}, PM_{10-2.5} mass, speciated PM_{10-2.5}, ozone, SO₂, CO, NO/NO_y, wind speed, wind direction, relative humidity, ambient temperature, and lead. (at this point there is no method to sample speciated PM_{10-2.5}.) It is our intent to meet these requirements at the Blair Street site, including utilizing a TSP Federal Equivalent Method sampler for lead by January 1, 2011.

2. Experimental Roadway NO₂ Monitoring site.

OAQPS has indicated that it intends to fund a few projects for monitoring this parameter similar to the new NO₂ NAAQS monitoring requirements. We indicated our interest in this project, and if it is feasible once OAQPS finalizes the plan, we hope to be able to operate one of these sites in the St. Louis area if funded by EPA, within the agreed time-frame.

3. Revised PM_{2.5} Monitoring

The revised PM_{2.5} monitoring network submitted in 2009 included continuous FEM TEOM sampling, everyday FRM sampling, and collocated FRM monitoring at the Troost site, due to the need to have a significant number of data points for continued method evaluation. We now believe that we have collected enough data at this higher monitoring frequency so that only one FRM with a lesser sampling frequency is necessary for comparison of data under the two methods. This is effective immediately.

In addition, PM_{2.5}/PMCoarse dichotomous samplers (FEM for PM_{2.5}) will be employed at the Blair Street and St. Joseph pump station sites by the end of CY2010. The TEOM samplers currently at each site will be used as spares should any in the network malfunction. Following is a network design very similar to last year's with the exception of the revised Troost FRM sampling.

REVISED PM_{2.5} MONITORING NETWORK

Site	Schedule*	Type	Agency	NAAQS
1. Blair St.	1	FRM	City	24 hr & Annual
	12	Collocated	City	
	3	Speciation	City	
	H	TEOM-Dichot**	City	AQI
2. Branch St.	3	FRM	City	24 hr & Annual
3. South Broadway	1	FRM	City	24 hr & Annual
4. Ladue	H	TEOM FEM	County	24 hr &
Annual/AQI				
5. Arnold	3	Speciation	ESP	
	H	TEOM FEM	ESP	24 hr &
Annual/AQI				
6. Liberty	3	Speciation	ESP	
	H	TEOM FEM	ESP	24 hr &
Annual/AQI				
7. Troost	3	FRM	ESP	24 hr & Annual
	H	TEOM FEM	ESP	24 hr &
Annual/AQI				
8. Richards-Gebaur South	H	TEOM FEM	ESP	24 hr &
Annual/AQI				
9. MSU	3	FRM	S/GC	24 hr & Annual
	12	Collocated	S/GC	
	H	SHARP	S/GC	
10. Pump Station	H	TEOM-Dichot**	ESP	AQI 24 hr &
Annual/AQI				
11. El Dorado Springs	H	TEOM FEM	ESP	24 hr &
Annual/AQI				
	3	IMPROVE	ESP	
12. Bonne Terre	3	Speciation	ESP	
13. Mingo	3	IMPROVE	FWS	
14. Hercules Glades	3	IMPROVE	FS	

1 = Everyday sampling; 3 = Every third day; 6 = Every sixth day; H = Continuous monitoring, hourly data reported.

** PM_{2.5} FEM method

4. Relocated Ozone Monitoring to Branson, MO and lengthened ozone monitoring season.

We have determined that ozone sampling at the SPMS site at Carthage is redundant with respect to the Alba SLAMS site. Values at Carthage are highly correlated with Alba, however Alba shows higher design values. In addition, values at Alba have been higher than expected, much more so than sites in other areas that began sampling in 2009, with its' annual fourth high value second in the state only to the Trimble site. The Carthage monitor was located 5.9 miles to the east-southeast of the Alba monitor site. Data was obtained for both Carthage and Alba, Missouri. This included the top ten (10) highest ozone readings for 2009, meteorological data from onsite data at Carthage and meteorological data from the official Joplin Airport weather observations.

The top 10 readings of Carthage and Alba ranged from .076 parts per million (ppm) to .065 ppm. There were a total of 12 days that occurred, 10 of which were on the same dates (please see below). Out of the 10 highest readings, Carthage averaged .002 ppm lower than the site at Alba.

The wind directions recorded at both Carthage and the Joplin Airport on these dates were in close agreement from the south to southwest, with differing wind speeds. The Joplin Airport reported winds between three and 17 mph while Carthage instruments reported wind speeds of one to five mph during these times. Carthage instruments are more protected in a rolling hill topography along with trees in the area (surface friction) while the Joplin Airport is in a relatively wide open flat area. This may be the reason for higher wind speeds recorded at the airport.

A further examination of ozone data was completed. The top 20 high readings were reviewed and showed Alba continued to have slightly higher readings than Carthage. Correlation results between Carthage and Alba also revealed that Alba remained with higher readings than Carthage. Correlation results show concentrations at the two sites are passively related with an r-value of near 91 percent.

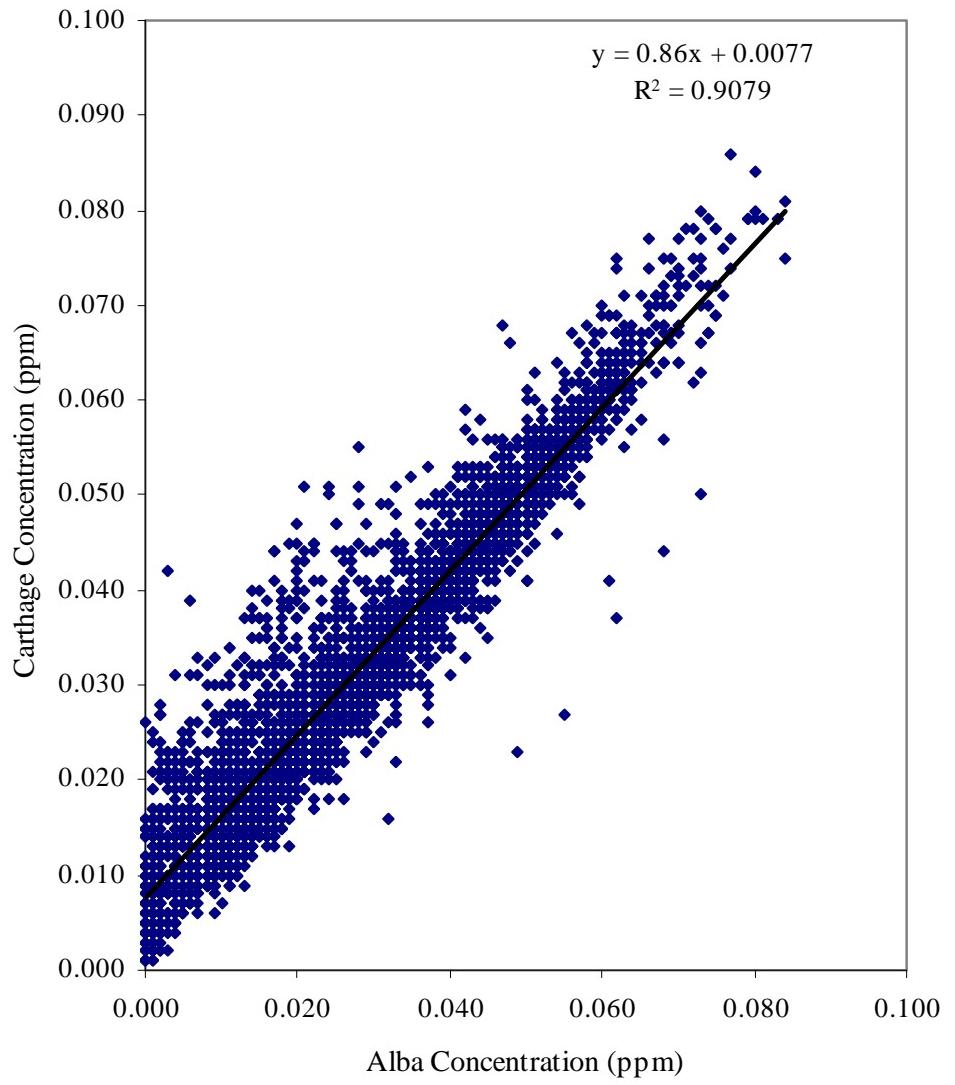
It has become apparent that there are several MSAs outside the state with very high population growth rates, from which associated emissions growth may contribute to elevated ozone in the southwest Missouri region, including the Rogers/Fayetteville, Fort Smith, and Tulsa MSAs. We believe we should evaluate concentrations for the Branson area, given the high level of visitor populations during the summer months. Consequently, we have relocated the Carthage sampler to the Branson Micropolitan Statistical Area as a SPMS site.

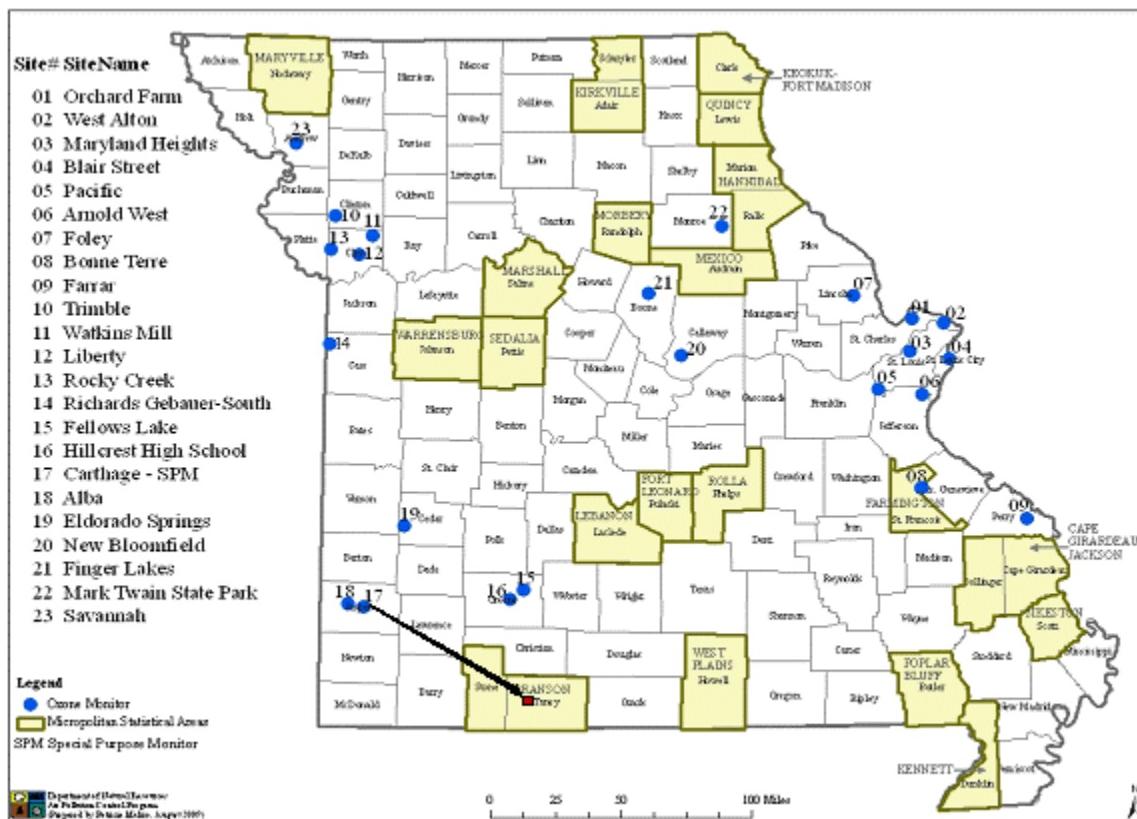
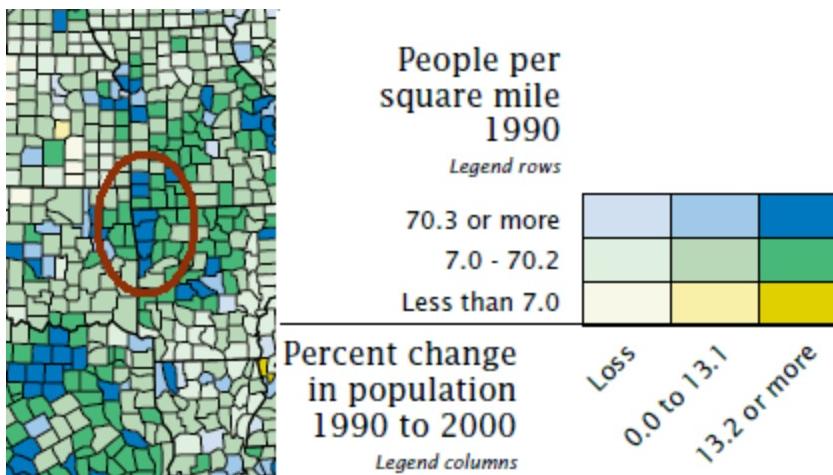
In addition, monitoring in the proposed ozone standard revision is set to begin March 1, 2011 in Missouri, and state and local monitoring will follow that requirement.

TOP 10 READINGS FROM BOTH CARTHAGE AND ALBA 2009

DATE	LOCATION	o3	HOUR	DIF.		
22-Apr	CARTHAGE	76	11	2		
22-Apr	ALBA	74	11			
20-May	CARTHAGE	71	9	0		
20-May	ALBA	71	10			
30-May	CARTHAGE	65	12			
31-May	CARTHAGE	73	8	-1		
31-May	ALBA	74	8			
5-Jun	CARTHAGE	67	10	-1		
5-Jun	ALBA	68	10			
25-Jun	CARTHAGE	65	12	-3		
25-Jun	ALBA	68	12			
26-Jun	CARTHAGE	71	9	-3		
26-Jun	ALBA	74	10			
27-Jun	CARTHAGE	73	9	-3		
27-Jun	ALBA	76	10			
11-Jul	ALBA	67	11			
24-Jul	CARTHAGE	65	10			
3-Aug	ALBA	69	11			
4-Aug	CARTHAGE	65	10	-1		
4-Aug	ALBA	67	10			

2009 Carthage and Alba Ozone Correlation





5. Temporary Monitor Discontinuances

The State of Missouri has been undergoing significant hardship with regard to state budgets because of the national recession. Based on the need to bring expenditures into line with available funds, we plan on temporarily discontinuing the samplers in the following table for the remainder of 2010 and 2011 (see site locations map, page four). These include several NO₂, SO₂, CO, PM10 and Pb criteria pollutant samplers and one each NH₃ and H₂S samplers. Most of these samplers are NO₂ and SO₂ and are required to be addressed in monitoring network plans by 2012 to meet network criteria in 2013. Until then there are no minimum requirements. There are no minimum requirements for CO sampler numbers, other than NCore which will be

maintained. The lead and PM10 samplers named are not required by CFR. All of these samplers, including the CO, NO₂, SO₂ and three PM10 samplers are showing levels well within NAAQS compliance for several years. The lead sampling consistently reports levels less than detection.

MONITORS TO BE TEMPORARILY DISCONTINUED

Site Name	Location	Proposed for temporary shutdown				
Margaretta	SL City		CO			
			SLAMS			
Mound St	SL City			PM10		
				SPMS		
S. Broadway	SL City		SO2			
			SLAMS			
Maryland Heights	SL County	NO2	SO2			
		SLAMS	SLAMS			
Ladue	SL County	NO2	SO2			
		SLAMS	SLAMS			
Clayton	SL County				Pb	
					SLAMS	
Sunset Hills	SL County	NO2		CO		
		SLAMS		SLAMS		
Hillcrest H. Sch.	Spg	NO2				
		SLAMS				
MSU	Spg		SO2	CO	PM10	
			SLAMS	SPMS	Collocated	
Liberty	ESP	NO2				
		SLAMS				
Bonne Terre	ESP	NO2				
		SLAMS				
Mark Twain State Park	ESP		SO2		PM10	
			SLAMS		SLAMS	
Green City	ESP					H2S
						SPM
						SPM
West Alton	ESP	NO2				
		SLAMS				
Totals		7 NO2	5 SO2	3 CO	3 PM10	1 Pb
						1 H2S
						1 NH3

**Tables of Sample Results Showing Compliance for
Samplers to be Temporarily Discontinued**

PM10 24hr (ug/m³)

Site Name	2003	2004	2005	2006	2007	2008	2009
2nd & Mound:							
1st Max	62	58	65	71	66	70	40
2 nd Max	57	49	63	55	66	38	37
3rd Max	47	46	61	44	60	38	36
4th Max	45	44	61	42	58	37	34
MSU:							
1st Max	40	36	45	35	38	39	27
2nd Max	39	30	44	30	37	34	26
3rd Max	30	30	38	29	36	29	25
4th Max	27	29	35	28	31	25	23
Mark Twain:							
1st Max	38	32	46	32	33	35	36
2nd Max	38	29	35	29	32	32	24
3rd Max	36	23	34	29	26	29	23
4th Max	31	23	33	25	26	27	23

SO2 98th Percentiles (ppm)

Site Name	2003	2004	2005	2006	2007	2008	2009
MSU	0.014	0.018	0.023	0.026	0.026	0.033	0.025
MTSP	0.013	0.023	0.015	0.012	0.012	0.012	0.013
Maryland Heights	-	-	0.033	0.035	0.038	0.035	0.041
Ladue	0.051	0.059	0.048	0.054	0.044	0.047	0.047
South Broadway	0.062	0.062	0.054	0.074	0.042	0.057	0.035

CO

Site Name	2003	2004	2005	2006	2007	2008	2009
1-hour 2nd High							
35 ppm							
Sunset Hills	-	-	1.7**	1.5	1.2	1.4	0.9
Margareta	4.5	4.3	4.7	3.9	3.4	4.2	2.4
MSU	4.0	4.0	4.0	3.0	4.0	1.8	2.2
8-hour 2nd High							
9 ppm							
Sunset Hills	-	-	1.3	1.2	1.0	0.8	0.7
Margareta	3.0	2.8	3.0	2.5	2.7	2.8	1.7
MSU	2.0	2.4	2.8	2.1	2.1	1.2	1.3

NO2 1 hr average (ppm) - Daily max 99th Percentile, 3 year avg

	00-02	01-03	02-04	03-05	04-06	05-07	06-08	07-09
West Alton	0.042	0.041	0.038	0.039	0.041	0.043	0.040	0.038
Sunset Hills	0.059	0.058	0.053	0.051	0.048	0.049	0.047	0.045
Maryland Hts	-	-	-			0.047	0.046	0.039
Ladue	0.068	0.065	0.061	0.055	0.054	0.052	0.050	0.047
Liberty	0.045	0.044	0.042	0.043	0.042	0.042	0.043	0.042
Hillcrest	0.055	0.059	0.057	0.058	0.053	0.054	0.052	0.051
Bonne Terre	0.019	0.022	0.025	0.026	0.024	0.024	0.021	0.021

Network Description/Components

See Appendix 2 for the Network Description, which includes the following components.

Site Data

All ambient air monitoring sites are recorded in the EPA's Air Quality System (AQS) database. Data includes location data such as latitude & longitude.

AQS Site Code

The site code includes a numerical designation for State, county, and individual site. The state and county codes are assigned a number based on the alphabetical order of the State or county. Site numbers are assigned sequentially by date established in most counties. St. Louis County sites also have a division for municipality within St. Louis County.

Street Address

The official Post Office address of the lot where the monitors are located. Because not all sites are located in cities or towns, the street address is occasionally given as the intersection of the nearest streets or highways.

Geographical Coordinates

The coordinate system used by Missouri Department of Natural Resources is latitude and longitude.

Air Quality Control Region (AQCR)

Air Quality Control Region are defined by EPA and designates either urban regions, like St. Louis or Kansas City, or rural sections of a State, such as northeast or southwest Missouri.

AQCR AQCR Name

070	Metropolitan St. Louis
094	Metropolitan Kansas City
137	Northern Missouri
138	SE Missouri
139	SW Missouri

Metropolitan Statistical Area

MSAs are defined by the U.S. Census Bureau.

<u>MSA Code</u>	<u>MSA Name</u>
0000	Not in a MSA
1740	Columbia, MO
3710	Joplin, MO
3760	Kansas City, MO-KS
7000	St. Joseph, MO
7040	St. Louis, MO-IL
7920	Springfield, MO

Monitor Data

Each monitor is designed to detect a specific chemical pollutant or group of related pollutants. A site may have one or many monitors and not all sites will have the same monitors.

Pollutant

The common name of the pollutant. “Criteria” pollutants are defined by statute in the Clean Air Act.

AQS Pollutant Code

Each pollutant has a specific numerical code to distinguish it from others. One monitor in St. Louis City uses a code of ‘00000’ because the monitor detects an entire group of chemicals, volatile organic pollutants, which are too numerous to list individually.

<u>Pollutant Code</u>	<u>Pollutant</u>
00000	VOCs
12128	Lead
14129	Lead – Local Conditions
42101	Carbon Monoxide
42242	Mercury vapor
42401	Sulfur Dioxide
42402	Hydrogen Sulfide
42406	Sulfur Dioxide 5-min
42602	Nitrogen Dioxide
42604	Ammonia
43502	Formaldehyde
44201	Ozone
45201	Benzene
45202	Toluene
61103	Resultant Wind Speed
61104	Resultant Wind Direct
62101	Outdoor Temperature
62107	Indoor Temperature
62201	Relative Humidity
63301	Solar Radiation
64101	Barometric Pressure
81102	PM ₁₀
84313	Black Carbon
85101	PM ₁₀ - LC
88101	PM _{2.5} FRM
88500	PM _{2.5} Tot Atmospheric
88501	PM _{2.5} Raw Data
88502	PM _{2.5} AQI/Speciation
88503	PM _{2.5} reference

POC

The Parameter Occurrence Code distinguishes between different monitors for the same pollutant, most often collocated monitors used for precision and quality assurance. For PM_{2.5}, different POCs are assigned to FRM, collocated FRM, continuous, and speciation monitors.

Collocated

Collocated monitors are used for precision and quality assurance activities, and for redundancy for critical pollutants such as ozone.

Sampling Frequency

Sampling frequency varies for each pollutant, depending on the nature of the NAAQS standard and the technology used in the monitoring method. Most gaseous pollutants use continuous monitors and are averaged over one hour. Particulate pollutants are mostly filter-based and averaged over one day.

Scale of Representation

Each monitor is intended to represent an area with similar pollutant concentration. The scales range from only a few meters to many kilometers.

MIC Microscale - defines the concentration in air volumes associated with area dimensions ranging from several meters up to about 100 meters.

MID Middle - defines the concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 kilometers.

NBR Neighborhood - defines concentrations within an extended area of a city that has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometers.

URB Urban - defines an overall citywide condition with dimensions on the order of 4 to 50 kilometers.

REG Regional - defines air quality levels over areas having dimensions of 50 to hundreds of kilometers.

Monitoring Objective

Each monitor has a distinct objective such as providing real-time data for public awareness or use in determining compliance with regulations.

<u>Objective Code</u>	<u>Objective</u>
AQI	Public Information
COM	NAAQS Compliance
MET	Meteorological Data
RES	Research
STA	State Standard

Units

The physical terms used to quantify the pollutant concentration, such as parts per million or micrograms per cubic meter.

<u>Unit Code</u>	<u>Unit Description</u>
001	$\mu\text{g}/\text{m}^3$
007	parts per million
008	parts per billion
012	miles per hour
013	knots
014	degree, compass
015	degree Fahrenheit
017	degree Celsius
018	Langleys
019	percent humidity
022	inches Mercury
025	Langleys per minute
105	$\mu\text{g}/\text{m}^3$ LC
121	parts per trillion

Monitoring/Analytical Method

Each monitor relies on a scientific principle to determine the pollutant concentration, which is described by the sampling method. Each method code is specific for a particular pollutant; therefore a three numeral code may be used for different methods for different pollutants.

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